Amendments to the Claims

Please amend claims 1, 9, 16, 17, 20, 56 and 59 and add new claims 73 - 77.

1. (Currently Amended) An implantable system, comprising:

a sensor for detecting heart sounds and for generating sensed signals representative of the heart sounds;

an interface circuit for communicating with an external system; and

a control circuit that includes an ensemble averager, coupled to the sensor and the interface circuit, configured to receive the sensed signals, to generate data representative of the heart sounds from the sensed signals from an average of the signals, and to transmit the data to the external system via the interface circuit, wherein the sensor, interface circuit and control circuit are implantable.

2. (Original) The system of claim 1, wherein the sensor includes an accelerometer.

3. (Original) The system of claim 1, further comprising an implantable housing for the control circuit, wherein the sensor is located internal to the implantable housing.

4. (Original) The system of claim 1, further comprising an implantable housing for the control circuit, wherein the sensor is located external to the implantable housing.

5. (Original) The system of claim 1, wherein the interface circuit is configured to communicate with the external system using radio-frequency (RF) signals.

6. (Original) The system of claim 1, wherein the interface circuit is configured to communicate with the external system using optical signals.

7. (Original) The system of claim 1, wherein the data transmitted by the control circuit to the external system includes raw data determined by digitizing the sensed signals.

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8. (Original) The system of claim 1, wherein the data transmitted by the control circuit to the external system includes processed data from processing the sensed signals.

9. (Currently Amended) An implantable system, comprising:

a first sensor for detecting heart sounds and for generating first sensed signals representative of the heart sounds;

a second sensor for detecting cardiac electrical signals and for generating second sensed signals representative of the cardiac electrical signals;

an interface circuit for communicating with an external system; and

a control circuit that includes a bandpass filter and an ensemble averager, coupled to the sensors and the interface circuit, configured to receive the first and second sensed signals, to generate first data representative of the heart sounds from the first sensed signals by filtering and averaging the signals, to generate second data representative of the cardiac electrical signals from the second sensed signals, and to transmit the first data and the second data to the external system via the interface circuit, wherein the first sensor, second sensor, interface circuit and control circuit are implantable.

10. (Original) The system of claim 9, wherein the first sensor includes an accelerometer.

11. (Original) The system of claim 9, further comprising an implantable housing for the control circuit, wherein the first sensor is internal to the implantable housing.

12. (Original) The system of claim 9, further comprising an implantable housing for the control circuit, wherein the first sensor is external to the implantable housing.

13. (Original) The system of claim 9, wherein the second sensor includes an EGM sensing electrode and the second sensed signals are representative of EGM electrical signals.

14. (Original) The system of claim 9, wherein the second sensor includes an atrial sensing electrode and the second sensed signals are representative of atrial electrical signals.

15. (Original) The system of claim 9, wherein the second sensor includes a ventricular sensing electrode and the second sensed signals are representative of ventricular electrical signals.

16. (Currently Amended) The system of claim 9, wherein the second sensor is adapted to be disposed in the right side of the heart.

17. (Currently Amended) The system of claim 9, wherein the second sensor is adapted to be disposed in the left side of the heart.

18. (Original) The system of claim 9, wherein the first data transmitted by the control circuit to the external system includes raw data determined by digitizing the first sensed signals.

19.(Original) The system of claim 9, wherein the first data transmitted by the control circuit to the external system includes processed data from processing the first sensed signals.

20. (Currently Amended) An implantable system, comprising:

a first sensor for detecting heart sounds and for generating first sensed signals representative of the heart sounds;

a second sensor for detecting first cardiac electrical signals and for generating second sensed signals representative of the first cardiac electrical signals;

a third sensor for detecting second cardiac electrical signals and for generating third sensed signals representative of the second cardiac electrical signals;

an interface circuit for communicating with an external system; and

a control circuit that includes an ensemble averager and a systole detector, coupled to the sensors and interface circuit, configured to receive the first, second and third sensed signals, to generate first data representative of the heart sounds from the first sensed signals by an ensemble

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average triggered from the detection of systole, generate second data representative of the first cardiac electrical signals from the second sensed signals, generate third data representative of the second cardiac electrical signals from the third sensed signals, and transmit the first, second and third data to the external system via the interface circuit, wherein the sensors, interface circuit and control circuit are implantable.

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21. (Original) The system of claim 20, wherein the first sensor includes an accelerometer.

22. (Original) The system of claim 20, wherein the second sensor includes an atrial sensing electrode, and the third sensor includes a ventricular sensing electrode.

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56. (Currently Amended) A method of outputting heart sounds using an implanted sensor, comprising:

detecting heart sounds using a first implanted sensor;

generating data representative of the heart sounds using ensemble averaging; and

transmitting data representative of the heart sounds to an external system.

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57. (Original) The method of claim 56, further comprising detecting first cardiac electrical signals using a second implanted sensor, and transmitting data representative of the first cardiac electrical signals to the external system.

58. (Original) The method of claim 57, further comprising detecting second cardiac electrical signals using a third implanted sensor, and transmitting data representative of the second cardiac electrical signals to the external system.

59. (Currently Amended) A method of outputting heart sounds using an implanted system, comprising:

generating first data representative of heart sounds in the implanted system using ensemble averaging;

receiving first data representative of detected heart sounds from the implanted system;

generating control signals using the first data; and

applying the control signals to an output device to cause the output device to generate outputs which are representative of the detected heart sounds.

60. (Original) The method of claim 59, further comprising receiving surface ECG data, wherein generating the control signals also includes using the surface ECG data, and applying the control signals to the output device also causes the output device to generate surface ECG outputs which are representative of the surface ECG.

61. (Original) The method of claim 60, further comprising outputting relative timing information between the heart sounds and surface ECG events on the output device.

62. (Original) The method of claim 59, further comprising receiving second data representative of first cardiac electrical signals from the implanted system wherein generating the control signals includes using;
the second data, and applying the control signals to the output device causes the output device to generate outputs which are representative of the heart sounds and the first cardiac electrical signals.

63. (Original) The method of claim 62, further comprising outputting relative timing information between the heart sounds and the first cardiac electrical signals on the output device.

64.(Original) The method of claim 62, further comprising receiving third data representative of second cardiac electrical signals from the implanted system, wherein generating the control signals includes using the third data, and applying the control signals to the output device causes the output device to generate outputs which are representative of the heart sounds, and the first and second cardiac electrical signals.

65. (Original) The method of claim 64, further comprising outputting relative timing information between the heart sounds, the first cardiac electrical signals, and the second cardiac electrical signals on the output device.

73. (New) The system of claim 1, wherein the control circuit further includes a systole detector coupled to the ensemble averager, wherein detection of systole triggers the ensemble averager.

74. (New) The system of claim 1, wherein the control circuit further includes a band pass filter coupled to the sensor and ensemble averager, wherein the output of the band pass filter is applied to the ensemble averager.

75. (New) The system of claim 1, wherein the control circuit further includes:

a band pass filter to receive signals from the sensor;

a rectifier coupled to the band pass filter; and

a low pass filter coupled to the rectifier and the ensemble averager.

76. (New) The system of claim 59, wherein the averaging includes sequentially averaging a number of completed cardiac cycles over a period of time.

77. (New) The system of claim 59, wherein the averaging includes averaging a number of completed cardiac cycles while a patient condition is present.